

of the year. Bristol, with a much smaller income, did not spend it all. Dundee just about made both ends meet. Bedford College, London, had a small deficit. King's College, London, with an income of 33,282*l.*, managed to save 618*l.* University College, London, spent rather more than its income. The college at Newcastle had a deficit. Nottingham had been adopting a saving policy with a view to future developments, and arrived at the end of the year with a good balance. Reading spent more than it received, and Southampton was in want of money. Though the conditions have been modified to some extent since the year with which the report deals, there is still the same careful and economical management required at all these colleges, and desirable improvements and developments have to be postponed for lack of funds. We hope it will not be long before the Government is able to provide more than 100,000*l.* for higher education, and that increased State aid will be supplemented by greater munificence on the part of our men of wealth.

A NEW era in the chemical department of the Scottish universities has been inaugurated by the erection of a chemical research laboratory at St. Andrews University by the munificence of Prof. Thomas Purdie, F.R.S., at a cost of about 9000*l.* Moreover, the 5000*l.* originally set aside by the University Court from the Carnegie trust



The Purdie Chemical Research Laboratory, University of St. Andrews.

quinquennial grant for buildings, &c., to aid in this work has, by a subsequent arrangement of the Court and the Carnegie trust, been constituted an endowment for the upkeep of the chemical research department. A teaching chemical laboratory had previously been presented to the University by the generosity of Mrs. Thomas Purdie, late of Castlecliffe. The former occupants of the chair, viz. Profs. Connel and Heddle, were distinguished in their way, viz., the former in regard to the dew point and other subjects, and the latter in mineralogy and the chemistry of minerals, but chemical research proper dates from Prof. Purdie's appointment in 1884, and has now been firmly established in the University. The substantial new building, which is seen in elevation in the accompanying illustration, provides still further facilities for post-graduate work. On the ground floor is a graduates' research laboratory with ten benches, each with high- and low-pressure water-taps, electric light and power, and there are also balance, operation, physical and dark rooms. Ventilation, light and heat are perfect, so that the workers are under the best possible conditions. On

the second floor is the professor's laboratory for four workers, a library, museum, spacious lecture-room, and various preparation rooms. The progress of the University as a chemical research school has been rapid, for previous to 1884 the accommodation was altogether inadequate. Now the facilities for teaching and research are not behind those of any of the modern German institutions. Moreover, not only St. Andrews students, but other capable workers are welcomed. Working in conjunction with the professor or lecturer on organic chemistry, students qualify for various scholarships, e.g. the Berry, Carnegie, and 1851 Exhibition scholarship, the research degree of London University, and the D.Sc. degree. The school has especially been noted for its work in optical activity and the chemistry of the sugars, but other subjects of biological interest have also been dealt with.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society. December 6, 1906.—“The Chemistry of Globulin.” By William Sutherland. Communicated by Dr. C. J. Martin, F.R.S.

The author's object in the present paper is first to establish simple formulæ for the more important of the experimental results obtained by Hardy and Mellanby, then to interpret these in their bearing upon the chemistry of globulin in connection with a theory of colloids, and finally to find the molecular mass (weight) of globulin.

By expressing the experimental results of Hardy and Mellanby in simple formulæ, it is shown that the solution of globulin and its precipitation take place under simple conditions of chemical equilibrium. For example, if p is the fraction of a globulin suspension dissolved in a salt solution the concentration of which is the fraction q of C that is required just to dissolve the whole of the suspension, we get equation (1) $p(1-q) = Aq(1-p)$, in which A is the ratio of a velocity of solution to a velocity of precipitation. Mellanby's discovery of the dependence of M/C on valency and ionic velocity is applied to MA/C , M being molecular mass, and it is shown that when temperature varies, not only does MA/C depend upon the viscosity of the solvent water, but also on a function of temperature given in an equation which expresses the part played by globulin. It is noteworthy that this function has a minimum value about 40° C., near the temperature of warm-blooded animals.

For the precipitation of globulin by excess of $(NH_4)_2SO_4$, an equation is established, namely, $p(1+p) = 28.8(c - 0.152)$, p being the fraction which the precipitated globulin is of the whole, and c the concentration of

the $(NH_4)_2SO_4$ solution in grams per cubic centimetre.

Then follow formulæ for the remarkable precipitation of globulin by acids from solution in neutral salts. From these it appears that three compounds of globulin react in producing this precipitate.

Section iv. is devoted to a theory of the colloidal state, namely, that a colloid consists of molecules which are chemically united neighbour to neighbour by the action of valencies which are usually latent.

According to this chemical theory of the colloidal state, the term molecule ceases to have a useful meaning when applied to a colloid, so the term *semplar* is used to name that structure which is repeated like a pattern in three dimensions through a colloid. By suppression of the colloid-producing valencies of doublets, a mass of *semplars* is caused to fall into a collection of separate molecules. In illustration of the usefulness of this theory, it is applied to show the dependence of the coagulating power of an ion on its valency. It is then applied also to explain the remarkable fact that the amount of globulin dissolved by

a given salt solution from a globulin suspension depends on the concentration of the suspension. The action of the ions of a neutral salt in dissolving globulin is treated as only another manifestation of the same electrical effect which enables them to coagulate arsenious sulphide. This theory of the colloidal state leads to a theory of equation (1) and of the laws of A in it, especially that MA/C is proportional to the sum of the squares of the valencies of the ions of the electrolyte.

In Section v. the experiments of Hardy on the conductivities of globulin solutions are expressed by formulæ which admit of very simple interpretation, and connect these conductivities with those of ordinary electrolytes.

In Section vi. globulin is shown to have probably a molecular mass 40,000 and a basicity 2, the alternative being a mass 60,000 and basicity 3. Further experiments like those of Hardy on the ionic velocity of globulin and also on the coefficient of diffusion of globulin solutions would decide the matter, though doubtless various globulins differ in mass and basicity. A group, $C_{12}H_{20}N_3O_4$, related to polypeptides and peptones, is shown to be the predominant structure in albumins. The discrepant results of different experimenters on the precipitation of albumin by heavy metals fall into harmony when it is proved that they precipitated different integral numbers of a group such as this in combination with an equivalent of heavy metal.

February 7.—“Experiments made to determine the Conditions under which ‘Specific’ Bacteria derived from Sewage may be Present in the Air of Ventilating Pipes, Drains, Inspection Chambers, and Sewers.” By Major W. H. **Horrocks**. Communicated by Colonel D. Bruce, C.B., F.R.S.

Most sanitarians at the present time believe that when sewage is in a state of putrefaction and gas bubbles, rising through it, are bursting at the surface, bacteria may be ejected into the air of sewers. It is also considered possible that when sewage has dried on the surfaces of pipes bacteria may be separated as dried particles and carried some distance by currents of air passing through the pipes. But it is not generally credited that the mere passage of infected sewage through a well-laid drainage system will also cause the ejection of specific bacteria into the air contained in the pipes. The experiments detailed show that:—

(1) The bursting of bubbles at the surface of sewage under artificial and natural conditions may cause the ejection of bacteria, which, if air currents are present, may be carried some distance.

(2) Specific bacteria dried on the ventilating pipes of a drainage system may be separated and carried by currents of air passing through the system.

(3) Specific bacteria may be ejected from fresh sewage flowing through a sewer under natural conditions, independently of the creation of bubbles and the separation of dried particles. The ejection of bacteria occurs, not only when use is made of naked microbes such as are obtained from growths on agar, but also when typhoid stools are employed as the infecting agent.

The results obtained, especially as regards the ejection of bacteria from fresh sewage, are of great importance, and indicate that the disconnection of a house-drainage system from a public sewer is sound in principle, and that it would not be wise to remove the disconnecting trap and ventilate sewers by means of house-ventilating pipes or soil pipes.

Royal Microscopical Society, March 20.—Dr. J. W. H. Eyre, vice-president, in the chair.—Some South African Tardigrada: J. **Murray**. The author was indebted for the materials for his paper to Mr. W. Milne, of Uitenhage, Cape Colony, who, from time to time in 1906, forwarded moss containing bdelloid rotifers from various parts of Cape Colony. In addition to the rotifers, which were abundant, the moss yielded many Tardigrada. Fourteen species were found belonging to the genera Echiniscus, Milnesium, and Macrobiotus. Eight out of the fourteen species are distinct from any previously known.—Notes on a peculiar habitat of a Chlorophyte, *Myxoneura tenue*: A. D. **Hardy**. The *Myxoneura tenue* is usually found in rapidly flowing water frequently attached to submerged

parts of river-side plants, but more often to stones and dead twigs; it is also found in the locality in stone-paved gutters in which there is a rapid flow of water. The author also found it growing feebly in a small fish pond, about 10 feet diameter, where the water was nearly stagnant, but on some gold fish in the pond it grew luxuriantly, and the author thinks that some interest attaches to the adaptation of this stream-loving *Myxoneura*, which, unable to thrive in stagnant water, yet flourished on moving objects where it obtained necessary water friction. It may be added that the effect of this algal growth on the fishes was their premature death.

Mathematical Society, April 11.—Sir W. D. Niven, vice-president, in the chair.—An introduction to the metrical geometry of space of n dimensions: H. **Bateman**.—A note on Perott's theorem: H. **Hilton**.—Poisson's integral and its relation to the proof of Fourier's theorem: Dr. E. W. **Hobson**.—The values of the parameters for which a definite integral can be zero: H. **Bateman**.

PARIS.

Academy of Sciences, April 8.—M. A. Chauveau in the chair.—The photography of the infra-red solar spectrum: G. **Milochau**. By the use of alcoholic solutions of malachite green, full details of the exact method being given, the author has been able to prepare plates of high sensibility in the infra-red region. By the use of these plates photographs have been taken of the region 0.750 μ to 0.950 μ , one Angström unit having a length of about 0.1 mm. These plates show that the band A has the same structure as the band B. The line Z, previously described as a short band in the infra-red, has now been resolved into lines.—The surface engendered by a circular helix: Eugène **Barré**.—A problem of analysis intimately connected with the problem of cooling of a heterogeneous bar: W. **Stekloff**.—Orthogonal systems of functions and the equation of Fredholm: Frédéric **Riesz**.—The altitude of the Grand Pic de la Meije: Paul **Helbronner**. The mean result of the measurements is 3982.5 metres (summit of the signal), differing only by 4 metres from the earlier result of Durand.—The action of a magnetic field on ionised air in motion: A. **Blanc**. On the hypothesis that the mobilities of the ions are not modified by the magnetic field, an assumption shown to be accurate by direct experiment, it is found that the negative ions have a greater mobility than the positive ions, the ratios obtained varying between 1 and 1.6, the average of fourteen experiments giving 1.32.—The oscillations of a higher order (harmonics) in the electric spark: G. A. **Hemselech**. The existence of harmonics in the electric spark is clearly demonstrated experimentally by photographic means, an enlarged reproduction of one of the photographs being shown. It was found that the harmonics are in great part the cause of the luminosity of the metallic vapour in the spark.—The constitution of the atom and the law of Colomb: H. **Pellat**. It was shown in a previous paper that to bring the current theory of the atom into harmony with experimental results either the atom must have a form approximating to a flattened disc or Colomb's law ceases to be applicable at intra-atomic distances. In the present communication it is proved that a flattened form of the atom would not be stable, and consequently Colomb's law must cease to be exact at the very small distances of the order of intra-atomic distances; the attracting force must increase less rapidly than the inverse of the square of the distance or the repulsive force more rapidly.—Some observations concerning the note of M. Pellat on the constitution of the atom: Th. **Tommasina**. M. Pellat has assumed that the atom as a whole is neutral from the electric point of view; if this hypothesis is not true, the further reasonings of M. Pellat fall to the ground.—An apparatus for measuring the flow of liquids: M. **Krebs**. A description of a simple apparatus giving at any instant the flow of a liquid in litres per hour. It has been successfully employed in measuring the consumption of petrol in trials of petrol motors.—Remarks on the preceding note: M. **D'Arsonval**. The apparatus is remarkable for its simplicity and exactitude, and will be of service in a great number of laboratory experiments.—Positive light: P. **Villard**.—The nickel-tin alloys: Léon **Guillet**. Referring to a recent

publication by M. Vigouroux on this subject, the author gives a *résumé* of work already published concerning the nickel-tin alloys by Guettier, Gautier, and himself.—Some properties of the alkaline protoxides: E. **Rengade**. At 400° C. these oxides are decomposed into the dioxide and the metal, the latter volatilising. Liquid ammonia converts them into mixtures of hydrate and amide. Hydrogen at 180° C. to 200° C. reduces the oxides of rubidium, potassium, and sodium, forming a mixture in equimolecular proportions of hydrate and hydride.—Contribution to the study of the oxybenzoates: **Echsner de Coninck**.—Iodine derivatives of the methyl ethers of pyrocatechol: E. **Tassilly** and J. **Leroide**.—Sands and shingles of the Pas-de-Calais: **Réné Bréon**. A determination of the mineralogical composition of these sands and shingles shows that these minerals bear no relation to the rocks in the surrounding strata. They arise from old igneous rocks, the nearest deposits of which are 250 to 300 kilometres distant. For the rocks and shingle, the theory of ice transportation is a possible one, but this explanation can hardly apply to the transportation of many millions of cubic metres of sand, and the cause of the appearance of the latter remains unknown.—The artificial coloration of minerals: **Paul Gaubert**. In opposition to the views of Suida, the author is of opinion that the artificial coloration of fibres of chrysotile and other crystallised minerals is a purely physical phenomenon.—Tchernichewite, a new amphibole: L. **Duparc** and F. **Pearce**.—The presence of *Ustilago Maidis* on the adventitious roots of *Zea Mais* and of its *quadricolor* variety and on the biomorphoses which it presents: M. **Chiffot**.—Observations on supranal fat: V. **Babès**.—The purification of sewage by turf filters: **Henri Pottevin**. An account of experiments carried out for several months on a single filter. The rate of filtration was 400 litres per square metre per day, and the purification effected, details of which are appended, was very satisfactory.—Contribution to the study of the food of the sardine: **Casimir Cépède**.—Characters of the inter-tropical atmospheric circulation: L. **Teisserenc de Bort** and L. **Rotch**.

DIARY OF SOCIETIES.

THURSDAY, APRIL 18.

ROYAL SOCIETY, at 4.30.—On Reciprocal Innervation of Antagonistic Muscles: Tenth Note: Prof. C. S. Sherrington, F.R.S.—Fatty Degeneration of the Blood: S. G. Shattock and L. S. Dudgeon.—(1) The Rate of the Assumption of Chloroform by the Blood during Anaesthesia: (2) Function of the Red Corpuscles in Chloroform Anaesthesia: Dr. G. A. Buckmaster and J. A. Gardner.—The Fermentation of Glucosides by Bacteria of the Typhoid-coli Group, and the Acquisition of New Fermenting Powers by *Bacillus Dysenteriae* and other Micro-organisms: F. W. Twort.

ROYAL INSTITUTION, at 3.—The Birth and Affinities of Crystals: Prof. Henry A. Miers, F.R.S.

LINNEAN SOCIETY, at 8.—On the Ecologic Functions of Stolons and Cleistogamous Flowers: J. C. Shenstone.—On the Ecologic Aspect of Constitutional Variation in Fruit-culture: A. O. Walker.—On an Aberrant Form of Coccidæ: Hugh Scott.—Some Results of Inoculation of Leguminous Plants: Prof. W. R. Bottomley.—*Exhibits*: Nepal Barley and other Cereals cultivated at High Altitudes in Tibet: Dr. George Henderson.—Photographs of Sections of Woods: J. A. Weale.—Lantern Slides of Witches' Brooms: J. Saunders.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Flexibles: with Notes on the Testing of Rubber: A. Schwartz.

CHEMICAL SOCIETY, at 8.30.—The Magnetic Rotation of Hexatriene, $\text{CH}_2:\text{CH}:\text{CH}:\text{CH}:\text{CH}_2$, and its Relationship to Benzene and other Aromatic Compounds, also its Refractive Power: Sir W. H. Perkin.—Aromatic Azoimides, Part i., β -Hydroxyphenylazoimide: M. O. Forster and H. E. Fierz.—The Action of Hydrogen Peroxide on Potassium Cyanide: O. Masson.—The Action of Ethyl Oxalate on Thioacetanilide and its Homologues: S. Ruhemann.—Measurements of the Velocities of Saponification of the *l*-Menthyl and *l*-Bornyl Esters of the Stereoisomeric Mandelic acids: A. McKenzie and H. B. Thompson.—Indican: Preliminary Notice: A. G. Perkin and W. P. Bloxam.—Cupric Nitrite: P. C. Ray.—The Constituents of the Essential Oil of American Pennyroyal: Occurrence of a Dextro-Menthone: M. Barrowcliff.—The Action of Tribromopropane on the Sodium Derivative of Ethyl Acetoacetate: T. E. Gardner and W. H. Perkin.

OPTICAL SOCIETY, at 8.—Presidential Address. Physical and Engineering Uses of the Microscope: Walter Rosenhain.

FRIDAY, APRIL 19.

ROYAL INSTITUTION, at 9.—Nerve as a Master of Muscle: Prof. C. S. Sherrington, F.R.S.

SATURDAY, APRIL 20.

ROYAL INSTITUTION, at 3.—Studies in Magnetism: Prof. Silvanus P. Thompson, F.R.S.

THE ESSEX FIELD CLUB (at Essex Museum of Natural History, Stratford), at 6.30.—Annual Meeting.—On the Breeding of the Kite and Buzzard near Maldon in the 'Fifties and 'Sixties of Last Century: Miller Christy.—Memoranda on the Purple Sandpiper (*Tringa maritima*): Dr. J. Murie.—The Trees and Woodlands of Essex: J. C. Shenstone.

MONDAY, APRIL 22.

SOCIETY OF ARTS, at 8.—Detergents and Bleaching Agents used in Laundry Work: Prof. Herbert Jackson.

VICTORIA INSTITUTE, at 4.30.—Exploration in Asia Minor, as bearing on the Historical Trustworthiness of the New Testament: Sir William M. Ramsay.

SOCIOLOGICAL SOCIETY, at 8.—The Future of Voluntary Charity: C. J. Hamilton.

TUESDAY, APRIL 23.

ROYAL INSTITUTION, at 3.—Stimulation, Luminous and Chemical: Prof. William Stirling.

ZOOLOGICAL SOCIETY, at 8.30.

SOCIETY OF ARTS, at 4.30.—Social and Economic Conditions in Australia: Dr. John W. Hackett.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Continued discussion*:—The Pyrmont Bridge, Sydney, N.S.W.: P. Allan.—Swing Bridge over the River Avon, at Bristol: W. H. B. Savile.

WEDNESDAY, APRIL 24.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.

SOCIETY OF ARTS, at 8.—Rubber Cultivation in the British Empire: Herbert Wright.

THURSDAY, APRIL 25.

ROYAL SOCIETY, at 4.30.—*Croonian Lecture* On the Essential Constituents of the Nucleus and their Relation to the Organisation of the Individual: Prof. J. B. Farmer, F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Address by the President: T. Hurry Riches.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.

FRIDAY, APRIL 26.

ROYAL INSTITUTION, at 9.—New Illuminants: James Swinburne, F.R.S. PHYSICAL SOCIETY, at 5.—Electrical Conduction produced by Heating Salts: A. E. Garrett.—The Influence of Pressure upon Convection Currents, and a Criticism of J. Stark's Relation between Cathode Fall of Potential and Temperature: W. S. Tucker.—Solenoids which are turned by the Earth's Magnetic Field: W. B. Croft.—Simple Apparatus for mechanically illustrating the Tangent and Sine Laws: J. A. Tomkins.

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